



October 24, 2013

Union Carbide Corporation
A Subsidiary of The Dow Chemical Company
PO Box 8361
3200/3300 Kanawha Turnpike
South Charleston, WV 25303
U.S.A

Mr. William Wentworth
USEPA Region 3
1650 Arch Street
Philadelphia, PA 19103-2029

Re: *HPH and Tank 1010 Pore Water Characterization Report*
Bayer CropScience Institute Facility, Institute, West Virginia

Dear Mr. Wentworth:

Enclosed for review, please find one copy of the *HPH and Tank 1010 Pore Water Characterization Report* for the Bayer CropScience (BCS) Institute facility. Union Carbide Corporation is submitting this report on behalf of BCS. The information presented herein was completed in accordance with the investigation approach presented to the United States Environmental Protection Agency on November 14, 2012.

If you have any questions or would like to discuss this document further, please feel free to contact me at (304) 747-7788 or Kylie McCord/CH2M HILL at (678) 530-4231.

Sincerely,

Jerome E. Cibrik, P.G.
Remediation Leader

Enclosures

cc: Ruth Prince/USEPA Region 3
Catherine Guynn/West Virginia Department of Environmental Protection
Robert Lockemer/Bayer CropScience (electronic only)
Chintan Amin/ Bayer CropScience (electronic only)
Lennie Scott/Bayer CropScience
Jonathan Raess/Union Carbide Corporation (cover letter only)
Marianne Szul McClure/Union Carbide Corporation (cover letter only)
Kylie McCord/CH2M HILL

Final

**HPH and Tank 1010
Pore Water Characterization Report
Bayer CropScience Facility
Institute, West Virginia**

Prepared for

Union Carbide Corporation
A Wholly Owned Subsidiary of The Dow Chemical Company

October 2013

CH2MHILL®

1	Introduction.....	1-1
1.1	Purpose and Objectives	1-1
1.2	Site Background.....	1-1
1.2.1	HPH Area	1-1
1.2.2	Tank 1010 Area	1-2
1.3	Report Organization	1-2
2	Investigation Activities	2-1
2.1	Sampling Methodology	2-1
2.2	July 2009 Investigation.....	2-2
2.3	December 2012 Investigation.....	2-2
3	Conceptual Site Model	3-1
3.1	Site Setting	3-1
3.2	Geology and Hydrogeology	3-1
3.3	Constituent Conditions.....	3-2
3.4	Exposure Pathways	3-2
3.4.1	Human Exposure Pathway	3-2
3.4.2	Ecological Receptor/Pathways	3-2
4	Pore Water Characterization Results	4-1
4.1	Surface Water Screening Levels	4-1
4.2	Sampling Conditions	4-1
4.3	2009 Investigation.....	4-1
4.4	2012 Investigation - HPH Area.....	4-2
4.5	2012 Investigation - Tank 1010 Area.....	4-2
5	Summary	5-1
6	References	6-1

Appendixes

- A Standard Operating Procedure - Trident Probe
- B Data Quality Evaluation
- C Laboratory Analytical Reports

Tables

- 4-1 Summary of Water Quality Parameters
- 4-2 Summary of Analytical Results – 2009 Data
- 4-3 Summary of 2012 Analytical Results – HPH Area
- 4-4 HPH Area - Detected VOCs Exceeding Pore Water Cleanup Levels
- 4-5 Summary of 2012 Analytical Results – Tank 1010 Area
- 4-6 Tank 1010 Area - Detected VOCs Exceeding Pore Water Cleanup Levels

Figures

- 1-1 Facility Location Map
- 2-1 Pore Water Sampling Locations
- 4-1 Kanawha River Gauge Hydrograph - 2012
- 4-2 Toluene Isoconcentration Map - Deep Aquifer
- 4-3 Benzene Isoconcentration Map - Deep Aquifer
- 4-4 Ethylbenzene Isoconcentration Map - Deep Aquifer
- 4-5 Total Xylenes Isoconcentration Map - Deep Aquifer
- 4-6 Cross Section Locations
- 4-7 Geologic Cross Section C-C' - Benzene
- 4-8 Geologic Cross Section D-D' - Benzene

\$ FURQ P V DQG \$ EEUHYLDMRQM

AST	above ground storage tank
BAZ	biologically active zone
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
COPC	constituent of potential concern
CSM	conceptual site model
DPT	direct-push technology
facility	Bayer CropScience Facility in Institute, West Virginia
GSI	groundwater-surface water interface
HPH	high purity hydrocarbons
ORP	oxidation-reduction potential
PCE	tetrachloroethene
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act facility investigation
SOP	standard operating procedures
UCC	Union Carbide Corporation
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

SECTION 1

,QMRGXFWMRQ

This report documents the results of the 2012 pore water field investigation conducted along the Kanawha River, adjacent to the High Purity Hydrocarbons (HPH) and Tank 1010 areas at the Bayer CropScience Facility in Institute, West Virginia (facility). The work is part of the Resource Conservation and Recovery Act (RCRA) Corrective Action process conducted under the authority of the U.S. Environmental Protection Agency (USEPA). Previous pore water and source area investigation was conducted in 2009, which is detailed in the technical memorandum: *TW-63A/TW-63B Source Area Investigation Bayer CropScience Institute Facility Institute, West Virginia* (CH2M HILL 2010a).

3 XLSRVH DQG 2 EMFWYHV

The purpose of the pore water characterization is to address one of the primary remedial action objectives for the facility: to determine if volatile organic compounds (VOCs), primarily benzene, in groundwater are discharging to the Kanawha River above protective levels. If VOCs are discharging above protective levels, then a potential attenuation factor for groundwater to pore water will be evaluated and, as appropriate, the site-specific groundwater cleanup levels and area of potential remedial action will be adjusted based on the pore water results.

6 LM%DFNU RXQG

The facility is located in Institute, West Virginia, adjacent to the Kanawha River (Figure 1-1). The facility occupies approximately 433 acres consisting of two distinct areas, the main chemical plant and the Bayer CropScience Wastewater Treatment Plant. The site is within the Kanawha River floodplain, with an elevation of approximately 600 feet above mean sea level, and its topography is relatively flat, with the exception of steep slopes along the riverbank.

The facility began operations in 1943 as a synthetic rubber production plant during World War II owned by the federal government. Union Carbide Corporation (UCC, a wholly owned subsidiary of The Dow Chemical Company) purchased and operated the facility from 1947 to 1986. Rhone-Poulenc purchased the facility in 1986 and became Aventis CropScience in January 2000. Aventis CropScience became Bayer CropScience in 2002. The main chemical plant historically produced various hydrocarbon and agricultural products. More detailed information regarding historical activities at the facility and associated investigations is provided in RCRA facility investigation (RFI) reports (UCC 1995, 2001; KEMRON Environmental Services 2003; Key Environmental, Inc. 2006; CH2M HILL 2005), *Current Conditions Report* (CH2M HILL 2009), as well as other reports referenced herein.

+3+ \$UD

High concentrations of benzene were detected in monitoring wells TW-63A and TW-63B in 2008, and an investigation was conducted in summer 2009 to determine the source of the benzene concentrations (CH2M HILL 2010a). A source upgradient of wells TW-63A and

TW-63B was identified near former boring INS-0003 during the investigation (HPH source area). INS-0003 is located approximately 75-feet northeast of TW-63A/TW-63B.

The source of high benzene concentrations in soil and groundwater at the HPH Area is likely associated with four above ground storage tanks (ASTs) that occupied the site between the late 1940's and mid 2000's. The ASTs were used to store process residue waste, HPH fuel oil, and possibly other constituents historically manufactured at the facility. (CH2M HILL 2012a)

7.0 DQI 7.0.1 \$ UH

Elevated benzene concentrations were found in the deep aquifer zone to the east of the HPH area during the 2009 HPH investigation. Additional investigations in the area in 2010 and 2011 identified a separate source area associated with the former Styrene Unit (CH2M HILL 2010b, 2011). Tank 1010, which is still in use today, stored benzene from 1943 until 1981 (CH2M HILL 2011).

Based on investigation work completed in the rail unloading area located north of Tank 1010 in 2011 and 2012, the source of benzene in soil and groundwater near Tank 1010 is most likely associated with the piping trench that runs along the north side of the tank farm. Historically, benzene was unloaded from railcars that would connect to piping within the piping trench to transfer the contents to the ASTs. The benzene appears to have migrated laterally away from the piping trench for a limited distance through the vadose zone and horizontally downward through the shallow silt/clay zone down to the deep sand aquifer (CH2M HILL 2011). Groundwater flow in the deep aquifer zone has transported benzene to the south where conceptually there was potential for it to discharge to the Kanawha River through pore water in the sediment.

5. HSRU 2. U DQI 2. DMRQ

This report is divided into six sections:

- Section 1 is an overview and describes the investigation objectives.
- Section 2 describes the activities performed for the Kanawha River investigation.
- Section 3 discusses the facility conceptual site model (CSM).
- Section 4 presents the results of the pore water sampling and analysis for each remediation area.
- Section 5 summarizes the conclusions of the Kanawha River investigation.
- Section 6 lists the references cited in the report.

The appendixes contain supporting information.

SECTION 2

,QYHMMJ DMRQ\$ FMYLMH

Two pore water characterization events were conducted during July 2009 and December 2012 to assess potential discharges of groundwater contamination to the Kanawha River, and to develop an improved understanding of the relationship between groundwater constituent plumes and groundwater discharges to the Kanawha River. Information on the sampling events is provided below.

6 DP SOQJ0 HMRGR0J

Twenty-seven pore water locations were sampled over two sampling events. Twenty-six locations, shown on Figure 2-1, were sampled within the HPH and Tank 1010 areas. The other sample was collected approximately 800 feet downstream (not shown on figure). All samples were collected in accordance with the standard operating procedure (SOP) for the Trident probe (Appendix A). A Trident probe was used to collect the pore water samples from a boat in the Kanawha River. The Trident probe is a direct-push technology (DPT) system equipped with temperature, conductivity, and water sampling probes. Contrasts in temperature and conductivity between surface water and groundwater were used to determine if the locations sampled were representative of areas of venting groundwater. Onboard measurement of oxidation-reduction potential (ORP), pH, temperature, and conductivity differentials confirmed the samples were pore water and not surface water.

The water sampling probe was used to collect the pore water samples for laboratory analysis. The sampling probes were equipped with sand pack prefilters (well driller's sand) that reduce sample turbidity and improve collection efficiency. The Trident probe system also was equipped with a metal plate that served as a depth guide for probe insertion and prevented surface water drawdown.

Surface water parameters were measured at each of the sampling locations before the Trident probe was advanced in sediment. The probe was then advanced to a maximum depth of 12 inches below sediment surface, and in situ measurements of temperature, specific conductance, ORP, and pH of the pore water were compared to the surface water parameters. Upon verification that pore water was encountered, one pore water sample was collected at each location and subsequently submitted to Microbac Laboratories for analysis of VOCs by USEPA Method 8260B.

2.2.1.1 - July 2009 Field Activities

The July 2009 field activities were performed in accordance with the *Kanawha River Investigation Work Plan and Phase I Sampling and Analysis Plan* (CH2M HILL 2008). The investigation was part of the *TW-63A/TW-63B Source Area Investigation* (CH2M HILL 2010a) to investigate an area of elevated concentrations of VOCs, specifically benzene, measured in monitoring wells TW-63A and TW-63B, which are adjacent to the Kanawha River. Two data quality objectives were developed for this investigation:

- Locate and delineate the source area for the observed elevated groundwater benzene concentrations near monitoring well cluster TW-63A/TW-63B
- Collect data needed for remedial action design and implementation

Pore water samples were collected from three locations adjacent to the facility (two in the HPH and Tank 1010 areas [Figure 2-1], and one additional location down river) to provide an indication of the concentration of VOCs in pore water beneath the Kanawha River adjacent to areas of known VOC-impacted groundwater at the facility.

2.2.1.2 - December 2012 Field Activities

The most recent pore water event took place in December 2012. Locations were spatially distributed to be inclusive of the mapped extent of benzene. The following data quality objectives were developed for the investigation:

- Collect Kanawha River pore water samples adjacent to the HPH and Tank 1010 areas at the facility to determine pore water VOC concentrations
- Based on VOC pore water results:
 - Evaluate attenuation factors for groundwater to pore water and adjust the site-specific groundwater cleanup levels, if appropriate
 - Adjust area of potential remedial action, as appropriate, based on the area where pore water concentrations exceed cleanup levels

Twenty-four samples were collected adjacent to the HPH Area (8 locations) and Tank 1010 Area (16 locations). Samples, for the most part, were collected in transects consisting of three locations: near shore, mid, and outer location (Figure 2-1). The locations within each transect are approximately 40 feet apart, and each transect is approximately 60 feet apart from one another.

Based on the feel of the sediment and residual sediment on the probe, sediment in this area of the Kanawha River is predominantly sand/ silty-sand and cobbles. Slower flow rate and residual clay on the probe indicated the middle location of the transects had a higher clay content than the other sampling locations. Some sampling locations were adjusted in the field because of insufficient flow, insufficient penetration into the Kanawha River sediments, and/or obstructions in order to obtain pore water samples. Most sample locations were adjusted only a few feet; however, all proposed near shore sample locations in the Tank 1010 Area had to be moved approximately 10 feet further from shore because of a thick cable preventing access to near shore locations.

During the 2012 event, it was proposed that two of the sampling locations from 2009 (INS-0019 and INS-0020) be resampled to assess changes over time. However, site conditions prevented the locations from being resampled. The current from the outfall made positioning the boat difficult for location INS-0019. The location was sampled approximately 15-feet north/northeast of the 2009 sampling location. INS-0020 could not be resampled due to insufficient flow through the sampling device from the pore water, the location was adjusted approximately 30-feet east/southeast and assigned a unique location ID (INS-0315). Therefore, the 2009 and 2012 samples will be treated as independent sample locations.

SECTION 3

&RQFHSVXDO6 LM0 RGHO

This section presents a condensed, updated version of the CSM. A detailed version of the CSM is presented in the *Current Conditions Report* (CH2M HILL 2009).

6 LM6 HMLQJ

The facility is in a relatively flat, low-lying area, partly because of onsite filling and grading activities conducted in the past to support industrial operations adjacent to the Kanawha River. North of State Route 25, which parallels the northern facility boundary, the topography becomes comparably steeper as the topography transitions from the floodplain to hilly slopes. In general, the southern facility border that abuts the Kanawha River consists of steep slopes covered by riprap.

* HRQJ\ DQG+ \ GRJHRQJ\

The facility is located along a narrow elevated alluvial plain (approximately 1,200 to 3,500 feet wide) along the banks of the Kanawha River. A steep slope approximately 30 feet high is present along the river that transitions to a generally flat plain with a gentle slope toward the river. Beyond the northern facility boundary, the topography rises several hundred feet sharply up into a hilly area above the Kanawha River Valley.

Subsurface conditions at the facility consist of a sequence of alluvial deposits associated with the ancestral Kanawha River. These alluvial deposits are approximately 55 to 60 feet thick and consist primarily of interbedded gravel, sand, silt, and clay deposits. The thickness of the alluvium thins dramatically along the inland side of the facility as bedrock rises up to the hilly area. Site development has resulted in the addition of manmade and natural fill materials that range up to approximately 10 feet in thickness. An important subsurface feature is the presence of relatively thick strata of clay and silt along the riverbank.

The hydrogeologic system is strongly influenced by the physical conditions at the facility. Groundwater at the facility occurs under two different conditions. The first consists of perched zones in low-permeability horizons. These zones are limited in aerial extent and occur at depth of approximately 7 to 13 feet below ground surface (bgs). The second zone consists of an unconfined aquifer typically found at depths of 15 to 20 feet bgs. Groundwater flow is generally toward the Kanawha River, which is normally a gaining stream. Although groundwater flow is generally toward the river, variability in the permeability of the interbedded clay, silt, sand and gravel result in localized variations in flow direction. Within the aquifer, there appears to be a generally small downward gradient across most of the facility. A slight upward gradient likely occurs along the river where groundwater normally discharges to surface water.

1.1.1 Benzene

Previous investigations of the HPH and Tank 1010 areas, identified benzene as the primary COPC. Other COPCs identified at concentrations an order of magnitude lower than benzene include ethylbenzene, toluene, and total xylenes (CH2M HILL 2010a, 2010b, 2011, 2012a). In the HPH and Tank 1010 areas, benzene in groundwater flows toward the Kanawha River and is in close proximity to the river. Generally, benzene concentrations increase with depth in the aquifer.

1.1.2 Exposure Pathways

Exposure refers to the potential contact of a receptor with a chemical. USEPA (1998) describes exposure pathways in terms of five primary components, which are:

- A source and mechanism of chemical release
- A retention or transport medium
- An environmental transport mechanism
- A point of receptor contact with the contaminated medium (known as the exposure point)
- An exposure route (such as ingestion) at the contact point

These five components must be present for a potential exposure pathway to be considered complete and for exposure to occur. Potentially complete exposure pathways related to groundwater are discussed below for human and ecological receptors.

1.1.2.1 Human Exposure Pathways

The exposure pathway for this evaluation is recreational users of the Kanawha River that have the potential to be exposed to groundwater constituents that may discharge to the river, be taken up by fish in the water column of the river, and subsequently be ingested with fish tissue. Other potential exposure pathways associated with groundwater (direct contact through industrial use or as drinking water) are incomplete with the exception of potential vapor intrusion of VOCs from groundwater to indoor air, which has been evaluated separately in other reports.

1.1.2.2 Ecological Exposure Pathways

The following are considered complete pathways for ecological receptors:

- Exposure, by direct contact, of benthic organisms (i.e., invertebrates and fish) to constituents in pore water
- Exposure, by direct contact, of water column (i.e., pelagic) organisms (i.e., invertebrates and fish) to constituents in surface water following venting of pore water

Groundwater at the facility is not considered an exposure medium because it is not possible for ecological receptors to encounter groundwater until it discharges to a surface water body. Because of the presence of the Kanawha River, and known hydrogeological linkages to the site, groundwater is considered an important transport medium that links the facility to this riverine habitat. Upwelling (venting) groundwater, along with constituents with which it might be contaminated, may enter surface water as it passes through sediment. The transition zone at the surficial sediment is referred to as the groundwater-surface water

interface (GSI) and represents the zone over which the hydrology shifts from a groundwater-dominated to a surface water-dominated environment.

The top of transition zone is considered the biologically active zone (BAZ) since the majority of the benthic macroinvertebrate community is expected to reside here. Based on the behavior of the type of organisms expected to occupy the BAZ (e.g., bivalves, snails, amphipods, fish, aquatic insects, etc.), it is assumed to be approximately 12 inches deep. Venting contaminated pore water through the BAZ is the primary mechanism of potential exposure for ecological receptors in the BAZ. Additionally, because of dilution at the GSI, especially in strongly flowing environments such as the Kanawha River, secondary (less severe) exposures to vented contaminated groundwater typically occur for aquatic biota that exclusively occupy the water column (e.g., fish and plankton).

SECTION 4

3 RUH: DMU&KDUFMUJ DMRQ5 HXOV

This section presents the results from the pore water sampling events, including a brief evaluation of the pore water concentrations relative to the established surface water screening levels, as well as an overview of the basis of the surface water screening levels. After each pore water sampling event, the data were validated in accordance with the *West Virginia Operations Program Quality Assurance Project Plan* (CH2M HILL 2006). Appendixes B and C contain the data quality evaluation reports and laboratory analytical reports, respectively, for each pore water investigation.

6 XUDFH: DMU6 FUHQQJ/ HYHV

Surface water screening levels were derived for 15 site-specific VOCs using the iterative process presented in the *Groundwater to Surface Water Screening Levels and Risk Evaluation Report* (CH2M HILL 2012b). The screening levels were established to be protective of potential Kanawha River exposure pathways for human and ecological receptors.

The surface water screening levels were compared to pore water VOC concentrations to identify COPCs by remediation area. A constituent concentration greater than its respective surface water screening criterion indicates a potential risk to Kanawha River receptors, and as such, that constituent will be retained as a COPC for the remediation area.

6 DP SOQJ&RQGLMRQV

Water quality parameters were collected at each sampling location to verify the Trident probe was fully deployed into the sediment and pore water was being purged. The parameters are recorded in Table 4-1. The water quality parameters show a distinct differential between the surface water and pore water, indicating the samples collected were pore water. River stage data also were obtained from the U.S. Geological Survey website during the 2012 event to determine the samples were collected during optimal river conditions (Figures 4-1). The sampling event occurred when river levels were stable and between rain events.

QYHMMJ DMRQ

Three pore water samples were collected in 2009 (INS-0018, INS-0019, and INS-0020) to assess potential impacts from source areas to the Kanawha River. The main constituent of concern in the source areas (benzene) was not detected in the pore water samples. Five VOCs were detected at one or more pore water sampling locations: 1,2,4-trichlorobenzene; 1,2-dichlorobenzene; 1,4-dichlorobenzene; chlorobenzene; and carbon disulfide (Table 4-2). None of these compounds was detected at concentrations above the screening levels. In addition, none of these compounds were detected in the groundwater samples collected during this investigation.

The downstream sample location, INS-0018 (approximately 800 feet downstream), showed the same constituents as locations INS-0019 and INS-0020 and at similar concentrations (Table 4-2).

Figure 4-2, QYHMMJ DMRQ + 3 + \$ UH

Nine pore water samples were collected and analyzed for site-specific VOCs in 2012. Ten VOCs were detected in the pore water samples collected in 2012 (Tables 4-3 and 4-4).

Toluene was detected at six locations and exceeded the surface water screening criteria at one location, INS-0293 (12.5 micrograms per liter). Benzene (detected at two locations), ethylbenzene (detected at one location), and xylenes (detected at four locations) did not exceed the surface water screening criteria for samples collected in the HPH Area. Figures 4-2, 4-3, 4-4, and 4-5 illustrate the groundwater plumes for toluene, benzene, ethylbenzene, and xylenes, respectively, along with the locations of the adjacent pore water samples.

Figure 4-3, QYHMMJ DMRQ 7 DQN \$ UH

Seventeen pore water samples were collected and analyzed for site-specific VOCs in 2012. Six VOCs were detected in the pore water samples collected during 2012 (Tables 4-5 and 4-6). All detections were below their respective surface water screening criteria.

Benzene and ethylbenzene were not detected in the pore water. Toluene was detected at 14 locations, and xylenes were detected at 11 locations. Figures 4-2, 4-3, 4-4, and 4-5 illustrate the 2012 groundwater plumes for toluene, benzene, ethylbenzene, and xylenes, respectively, along with the locations of the adjacent pore water samples.

Cross sections were developed for two north-south transects in the Tank 1010 Area to illustrate the hydrogeologic conditions and for benzene concentrations in soil, groundwater, and pore water. The locations of the cross sections are shown on Figure 4-6, and the cross sections are presented on Figures 4-7 and 4-8.

SECTION 5

6XP P DU □

Twenty-seven pore water samples were collected within the Kanawha River adjacent to the facility. Twenty-six of those locations were sampled adjacent to the HPH and Tank 1010 groundwater plumes. River level data indicate samples were collected during stable conditions when groundwater normally discharges to surface water. Quality control samples from the field event indicate pore water was collected from the sampler. These data indicate the pore water sampling events collected representative samples of pore water and that the data can be used to characterize the groundwater/pore water relationship.

Results of the 2009 and 2012 pore water investigations indicate VOC concentrations in pore water in the HPH and Tank 1010 areas were below established screening levels for the Kanawha River, with the exception of toluene at one location in the HPH Area. Available hydrogeologic and VOC concentration data indicate the pore water samples were collected in locations where VOC-impacted groundwater is expected to discharge through pore water into the Kanawha River.

It was not possible to evaluate attenuation factors for groundwater to pore water because VOCs generally were not detected in pore water. The limited number of detected values is insufficient to calculate attenuation factors and adjust site-specific cleanup levels.

The results of this investigation will be used in the evaluation of the potential remedies for the Tank 1010 Area in a separate Tank 1010 Remedy Evaluation document. The results will also be used in the evaluation of operation duration for the HPH Area remediation system.

SECTION 6

5 H H H Q F M

CH2M HILL. 2005. *Supplemental RCRA Facility Investigation Report*. Union Carbide Corporation, Institute Facility, Institute, West Virginia.

CH2M HILL. 2006. *West Virginia Operations Program Quality Assurance Project Plan*. November.

CH2M HILL. 2008. *South Charleston Facility, Kanawha River Work Plan and Phase I Sediment and Pore Water Investigation Sampling and Analysis Plan, South Charleston, West Virginia*. Prepared for Union Carbide Corporation. July.

CH2M HILL. 2009. *Current Conditions Report*. Bayer CropScience Institute Facility. Prepared for Union Carbide Corporation. October.

CH2M HILL. 2010a. *TW-63A/TW-63B Source Area Investigation, Bayer CropScience Institute Facility*. February.

CH2M HILL. 2010b. *INS-0005 Source Area Investigation, Bayer CropScience Institute Facility*. March.

CH2M HILL. 2011. *Tank 1010 Source Area Investigation, Bayer CropScience Institute Facility*. December.

CH2M HILL. 2012a. *Former High Purity Hydrocarbon Storage Area Remedial Construction, Bayer CropScience Institute Facility*. Prepared for Union Carbide Corporation. June.

CH2M HILL. 2012b. *Groundwater to Surface Water Screening Levels and Risk Evaluation, Bayer CropScience Institute Facility*. Prepared for Union Carbide Corporation. November.

KEMRON Environmental Services, Inc. 2003. *RFI Stage III Additional Investigation Low Priority Solid Waste Management Units*. June.

Key Environmental. 2006. *Summary of Site Remediation*. Union Carbide Corporation, Institute Facility, Institute, West Virginia.

U.S. Environmental Protection Agency (USEPA). 1998. *Guidelines for ecological risk assessment*. EPA/630/R-95/002F.

Union Carbide Corporation (UCC). 1995. *RFI (Stage II) Report, Rhone-Poulenc Ag Company, Institute, West Virginia*. July.

Union Carbide Corporation (UCC). 2001. *RFI (Stage III) Report, Low Priority Solid Waste Management Units, Aventis Crop Science USA Institute, West Virginia*. February.

Tables

Sample			Water Depth (feet)	Trident Probe Sensors (<i>in situ</i>)		Ultrameter (<i>ex situ</i>)				
Station	Date	Location		Temp (°C)	Cond (mS/cm)	Temp ^a (°C)	Cond (mS/cm)	ORP (mV)	pH	TDS (mg/L)
2009 Investigation										
INS-0018	10-Jul-09	SW	8.0	25.214	0.240	25.9	234.6	151	7.32	153.1
		PW		NA	NA	29.1	1207.0	-139	6.63	844.3
INS-0019	10-Jul-09	SW	14.0	24.885	0.244	26.0	236.4	116	7.55	154.3
		PW		NA	NA	27.4	594.7	-121	6.55	403.3
INS-0020	10-Jul-09	SW	13.0	24.902	0.245	26.5	236.1	131	7.57	154.10
		PW		NA	NA	31.9	279.2	-91	6.94	180.7
HPH Area										
INS-0019	5-Dec-12	SW	10.0	7.717	0.220	8.3	214.0	261	6.92	102.0
		PW		8.613	NA	9.3	561.7	-79	6.85	251.4
INS-0293	4-Dec-12	SW	2.5	9.030	0.212	9.4	210.8	261	6.69	100.3
		PW		9.808	NA	15.0	694.0	14	6.58	333.7
INS-0294	4-Dec-12	SW	11.4	9.149	0.213	9.5	208.9	212	6.70	99.07
		PW		9.680	NA	20.4	538.3	-22	6.72	236.3
INS-0295	4-Dec-12	SW	22.2	9.031	0.211	9.7	206.8	205	6.76	98.21
		PW		9.331	NA	15.6	545.6	-67	6.74	241.6
INS-0296	4-Dec-12	SW	20.2	8.919	0.213	9.9	207.1	211	6.92	98.56
		PW		9.672	NA	14.5	429.7	-64	6.75	206.6
INS-0297	5-Dec-12	SW	8.5	8.182	0.218	8.1	214.6	248	6.77	102.3
		PW		9.083	NA	8.4	228.4	45	6.80	108.9
INS-0298	4-Dec-12	SW	17.9	7.277	0.218	9.6	206.7	225	7.00	98.68
		PW		8.902	NA	12.3	612.1	-63	6.65	282.3
INS-0299	4-Dec-12	SW	21.7	7.395	0.216	9.9	204.9	221	6.92	97.50
		PW		8.835	NA	15.3	452.3	-41	6.51	214.3
Tank 1010 Area										
INS-0300	5-Dec-12	SW	19.7	7.678	0.221	8.4	214.2	250	6.76	102.1
		PW		8.993	NA	12.7	327.8	-21	6.60	157.2
INS-0301	5-Dec-12	SW	21.9	7.568	0.222	8.8	215.7	255	6.83	102.7
		PW		9.038	NA	11.1	542.0	-19	6.33	239.7
INS-0302	5-Dec-12	SW	11.1	7.815	0.223	9.5	215.8	210	7.18	102.9
		PW		9.439	NA	12.3	432.4	-45	6.61	208.1
INS-0303	7-Dec-12	SW	17.7	7.627	0.215	7.9	209.8	256	6.71	99.95
		PW		9.019	NA	10.6	483.4	-32	6.54	214.5
INS-0304	5-Dec-12	SW	22.3	7.703	0.222	9.1	216.5	217	6.98	103.1
		PW		9.124	NA	12.8	306.6	-46	6.75	146.9
INS-0305	6-Dec-12	SW	11.6	7.621	0.243	8.3	242.5	196	6.97	115.9
		PW		9.350	NA	9.8	607.0	-59	6.55	279.0
INS-0306	6-Dec-12	SW	22.9	7.390	0.237	6.8	238.6	266	6.68	113.9
		PW		8.464	NA	3.5	317.8	16	6.69	152.3
INS-0307	7-Dec-12	SW	18.1	7.868	0.204	8.4	202.5	233	6.65	96.27
		PW		8.464	NA	12.1	396.7	-23	6.57	190.6
INS-0308	6-Dec-12	SW	23.5	7.424	0.243	7.0	235.4	227	6.68	112.3
		PW		8.702	NA	5.0	374.3	-7	6.71	179.4
INS-0309	6-Dec-12	SW	11.6	7.593	0.240	8.8	231.8	207	7.07	110.9
		PW		8.553	NA	10.7	451.8	-16	6.48	214.3
INS-0310	7-Dec-12	SW	21.0	7.842	0.206	8.2	196.5	204	6.58	93.52
		PW		9.022	NA	10.4	546.8	-35	6.47	242.2
INS-0311	6-Dec-12	SW	21.4	7.442	0.243	8.0	231.9	221	6.76	120.6
		PW		8.848	NA	7.5	621.3	-74	6.73	284.9
INS-0312	6-Dec-12	SW	9.9	7.612	0.238	8.4	230.6	251	6.68	109.7
		PW		9.056	NA	11.8	443.0	-59	6.79	212.9
INS-0313	6-Dec-12	SW	17.9	7.608	0.238	8.2	225.1	257	6.71	107.0
		PW		9.534	NA	13.0	316.7	-4	6.56	151.7
INS-0314	6-Dec-12	SW	22.8	7.287	0.244	7.8	231.6	213	6.90	110.5
		PW		8.556	NA	7.6	468.5	-21	6.51	214.4
INS-0315	7-Dec-12	SW	20.8	7.682	0.227	8.0	203.5	202	6.30	NA
		PW		11.246	NA	13.5	415.6	-35	6.44	200.1

^a Ultrameter temperatures artifically high due to running through long length of tubing; Trident Probe data considered most accurate

SW = Surface Water

PW = Pore Water

°C = degrees Celsius

Temp = temperature

Cond = conductivity

mS/cm = milliSiemens per centimeter

µS/cm = microSiemens per centimeter

ORP = oxidation-reduction potential

TDS = total dissolved solids

mV = millivolts

mg/L = milligrams per liter

NA = data not available

75% ()

Summary of Analytical Results - 2009 Data

HPH and Tank 1010 Pore Water Characterization Report

Bayer CropScience Facility, Institute, West Virginia

	Location	INS-0018	INS-0019	INS-0020
	Sample ID	0018-PW-071009	0019-PW-071009	0020-PW-071009
	Sample Date	7/10/2009	7/10/2009	7/10/2009
	Groundwater			
VOCs (µg/l)	Screening Levels*			
1,1,1-Trichloroethane	--	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	--	1 U	1 U	1 U
1,1,2-Trichloroethane	--	1 U	1 U	1 U
1,1-Dichloroethane	--	1 U	1 U	1 U
1,1-Dichloroethene	--	1 U	1 U	1 U
1,2,4-Trichlorobenzene	--	1.18	1.99	1.12
1,2-Dichlorobenzene	--	2.66	1.19	1 U
1,2-Dichloroethane	100	1 U	1 U	1 U
1,2-Dichloropropane	--	1 U	1 U	1 U
1,3-Dichlorobenzene	--	1 U	1 U	1 U
1,4-Dichlorobenzene	--	1.51	4.03	1.79
1,4-Dioxane	22,740	R	R	R
2-Butanone	--	10 U	10 U	10 U
2-Hexanone	--	5 U	5 U	5 U
4-Methyl-2-Pentanone	--	5 U	5 U	5 U
Acetone	--	25 U	25 U	25 U
Acrylonitrile	--	10 U	10 U	10 U
Benzene	130	1 U	1 U	1 U
Bromodichloromethane	--	1 U	1 U	1 U
Bromoform	--	1 U	1 U	1 U
Bromomethane	--	1 U	1 U	1 U
Carbon disulfide	105	1 U	1 U	1.9
Carbon tetrachloride	--	1 U	1 U	1 U
Chlorobenzene	--	5.8	1 U	1 U
Chloroethane	--	1 U	1 U	1 U
Chloroform	3,400	1 U	1 U	1 U
Chloromethane	--	1 U	1 U	1 U
cis-1,2-Dichloroethene	--	1 U	1 U	1 U
cis-1,3-Dichloropropene	--	1 U	1 U	1 U
Dibromochloromethane	--	1 U	1 U	1 U
Ethylbenzene	7.3	1 U	1 U	1 U
Methyl t-Butyl Ether	--	5 U	5 U	5 U
Methylene chloride	--	5 U	5 U	5 U
Styrene	72	1 U	1 U	1 U
Tetrachloroethene	--	1 U	1 U	1 U
Toluene	9.8	1 U	1 U	1 U
trans-1,2-Dichloroethene	--	1 U	1 U	1 U
trans-1,3-Dichloropropene	--	1 U	1 U	1 U
Trichloroethene	--	1 U	1 U	1 U
Vinyl acetate	--	10 U	10 U	10 U
Vinyl chloride	930	1 U	1 U	1 U
Xylenes, total	67	5 U	5 U	5 U

Notes:

R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet the quality control criteria. The presence or absence of the analyte cannot be verified.

< = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

VOCs = volatile organic compounds

µg/L = micrograms per liter

Bold = Detected

* Screening criteria calculated to be protective of Kanawha River exposure pathways.

-- = Screening criteria not calculated

TABLE 4-3
Summary of 2012 Analytical Results - HPH Area
HPH and Tank 1010 Pore Water Characterization Report
Bayer CropScience Facility, Institute, West Virginia

	Location Sample ID Sample Date Groundwater Screening Levels*	INS-0019 0019-PW-120512 12/5/2012	INS-0293 0293-PW-120412 12/4/2012	INS-0294 0294-PW-120412 12/4/2012	Duplicate	INS-0295 0295-PW-120412 12/4/2012	INS-0296 0296-PW-120412 12/4/2012	INS-0297 0297-PW-120512 12/5/2012	INS-0298 0298-PW-120412 12/4/2012	INS-0299 0299-PW-120412 12/4/2012
SVOCs (µg/L)										
Naphthalene	193	1 U	1.74	1 U	1 U	1 U	1 U	1 U	1 U	1 U
VOCs (µg/l)										
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	1 U	1.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane (p-Dioxane)	22,740	--	--	--	--	--	--	--	--	--
2-Butanone	--	10.5 J	16 J	12.8 J	8.25 J	5 UJ	5 UJ	8.9 J	9.1 J	5 UJ
2-Hexanone	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
Acetone	--	65.5	83.2	82.1 J	56.4 J	12.2	14.3 K	27.2	36.7	15.3
Acrylonitrile	--	--	--	--	--	--	--	--	--	--
Benzene	130	1 U	4.11	11	10	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	--	--	--	--	--	--	--	--	--	--
Bromomethane	--	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon disulfide	105	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	--	1 U	49.1	1 U	1 U	1 U	1 U	1 U	1.94	3.96
Chloroethane	--	--	--	--	--	--	--	--	--	--
Chloroform	3,400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethylene	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	7,522	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	7.3	1 U	1 U	1.3	1.37	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene chloride	--	1 U	1 U	1 U	1 U	1 U	1.22	1 U	1 U	1 U
Styrene	72	1 U	1 U	2.55	2.98	2.41	1 U	1 U	1 U	1 U
tert-Butyl Methyl Ether	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	9.8	1.19	12.5	1 U	1 U	1 U	2.2	3.72	7.12	2.13
Trans-1,2-Dichloroethylene	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--
Trichloroethylene	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl acetate	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes, Total	67	1 U	4.21	1.18	1 U	1 U	1 U	1.62	2.77	1 U

Notes:
* Screening criteria calculated to be protective of Kanawha River exposure pathways.
NA = Not analyzed
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample
K = The analyte was positively identified, but the associated numerical value may be biased high
R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet the quality control criteria. The presence or absence of the analyte cannot be verified
U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit
UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds
µg/L = micrograms per liter
Bold indicates the analyte was detected.
Shading indicates the result exceeded screening criteria.

7 \$% ()

HPH Area - Detected VOCs Exceeding Pore Water Cleanup Levels

HPH and Tank 1010 Pore Water Characterization Report

Bayer CropScience Facility, Institute, West Virginia

	Groundwater Screening Levels*	Minimum Detection	Maximum Detection	Number of Detections	Frequency of Exceedances	INS-0019 2009	INS-0019	INS-0293	INS-0294		INS-0295	INS-0296	INS-0297	INS-0298	INS-0299
VOCs (mg/l)										Duplicate					
1,2,4-Trichlorobenzene	--	1.99	1.99	1	0 / 8	1.99	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	--	1.19	1.19	1	0 / 8	1.19	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	--	1.4	1.4	1	0 / 8	4.03	ND	1.4	ND	ND	ND	ND	ND	ND	ND
2-Butanone	--	8.25	16	5	0 / 8	ND	10.5	16	12.8	8.25	ND	ND	8.9	9.1	ND
ACETONE	--	12.2	83.2	8	0 / 8	ND	65.5	83.2	82.1	56.4	12.2	14.3	27.2	36.7	15.3
Benzene	130	4.11	11	2	0 / 8	ND	ND	4.11	11	10	ND	ND	ND	ND	ND
Chlorobenzene	--	1.94	49.1	3	0 / 8	ND	ND	49.1	ND	ND	ND	ND	ND	1.94	3.96
Ethylbenzene	7.3	1.3	1.37	1	0 / 8	ND	ND	ND	1.3	1.37	ND	ND	ND	ND	ND
Naphthalene	193	1.74	1.74	1	0 / 8	ND	ND	1.74	ND	ND	ND	ND	ND	ND	ND
Styrene	72	1.22	2.98	3	0 / 8	ND	ND	ND	2.55	2.98	2.41	1.22	ND	ND	ND
Toluene	9.8	1.19	12.5	6	1 / 8	ND	1.19	12.5	ND	ND	ND	2.2	3.72	7.12	2.13
XYLENES, TOTAL	67	1.18	4.21	4	0 / 8	ND	ND	4.21	1.18	ND	ND	ND	1.62	2.77	ND

Notes:

ND = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

VOCs = volatile organic compounds

µg/L = micrograms per liter

Shading indicates the result exceeded screening criteria

* Screening criteria calculated to be protective of Kanawha River exposure pathways.

-- = Screening criteria not calculated

7/9/14 ()

Summary of 2012 Analytical Results - Tank 1010 Area
HPH and Tank 1010 Pore Water Characterization Report
Bayer CropScience Facility, Institute, West Virginia

Analyte SVOCS (µg/L)	Location Sample ID Sample Depth (ft) Sample Date	Groundwater Screening Levels*															
		INS-0300 0300-PW-120512 1-1 12/5/2012	INS-0301 0301-PW-120512 1-1 12/5/2012	INS-0302 0302-PW-120512 1-1 12/5/2012	INS-0303 0303-PW-120712 1-1 12/7/2012	INS-0304 0304-PW-120512 1-1 12/5/2012	INS-0305 0305-PW-120612 1-1 12/6/2012	INS-0306 0306-PW-120612 1-1 12/6/2012	INS-0307 0307-PW-120712 1-1 12/7/2012	INS-0308 0308-PW-120612 1-1 12/6/2012	INS-0309 0309-PW-120612 1-1 12/6/2012	INS-0310 0310-PW-120712 1-1 12/7/2012	INS-0311 0311-PW-120612 1-1 12/6/2012	INS-0312 0312-PW-120612 1-1 12/6/2012	INS-0313 0313-PW-120612 1-1 12/6/2012	INS-0314 0314-PW-120612 1-1 12/6/2012	INS-0315 0315-PW-120712 1-1 12/7/2012
Naphthalene	193	1U	1U	1.38	1U	1U	1.23	1U	1U	7.18	1U	1U	1.56	1U	1U	2.87	1U
VOCs (µg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1,2-Trichloroethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1,2,2-Trifluoroethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1,2-Trichloroethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethene	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	100	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,2-Dichloropropane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,4-Dioxane (p-Dioxane)	22,740	--	--	--	10.4	--	--	--	--	5U	--	--	--	--	--	--	--
2-Hexanone	--	33 J	13.8 J	5U	--	--	5U	--	14.4	5U	--	5U	5U	5U	--	5U	21.1
4-Methyl-2-pentanone	--	5UJ	5UJ	5U	5U	5UJ	5U	5.64	5U	5U	5U	5U	5U	5U	--	5U	5U
Acetone	--	129	68.1	5U	30.9	5U	--	--	41.9	5U	5.5	17.9	5U	11	16	5U	136
Acrylonitrile	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	130	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Bromodichloromethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Bromoforn	--	--	--	--	1UJ	--	--	--	1UJ	--	--	--	1UJ	--	--	--	1UJ
Bromomethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Carbon disulfide	105	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Carbon tetrachloride	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Chlorobenzene	--	1U	1U	1U	1U	1U	1U	2.8	1U	2.45	1U	1U	1U	1U	1U	1U	1U
Chloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	3,400	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Chloromethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
cis-1,2-Dichloroethylene	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Dichlorodifluoromethane	7,522	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Ethylbenzene	7.3	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Methylene chloride	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Styrene	72	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
tert-Butyl Methyl Ether	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Tetrachloroethene	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Toluene	9.8	1.15	1.52	2.03	1U	3.81	3.4	1.36	1U	1.63	2.87	2.86	3.24	2.93	1.22	1.73	1.7
Trans-1,2-Dichloroethylene	--	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl acetate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	--	1U	1U	1UJ	1U	1U	1UJ	1U	1U	1U	1UJ	1U	1U	1UJ	1UJ	1U	1U
Xylenes, Total	67	1.04	1.1	1.55	1U	1.8	2.07	1U	1U	1.33	1.68	1U	1.88	1.5	1U	1.15	2.24

Notes:
* Screening criteria calculated to be protective of Kanawha River exposure pathways.
NA = Not analyzed
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
K = The analyte was positively identified, but the associated numerical value may be biased high.
R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet the quality control criteria. The presence or absence of the analyte cannot be verified.
U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.
SVOCS = semivolatile organic compounds
VOCs = volatile organic compounds
µg/L = micrograms per liter
Bold indicates the analyte was detected
Shading indicates the result exceeded screening criteria

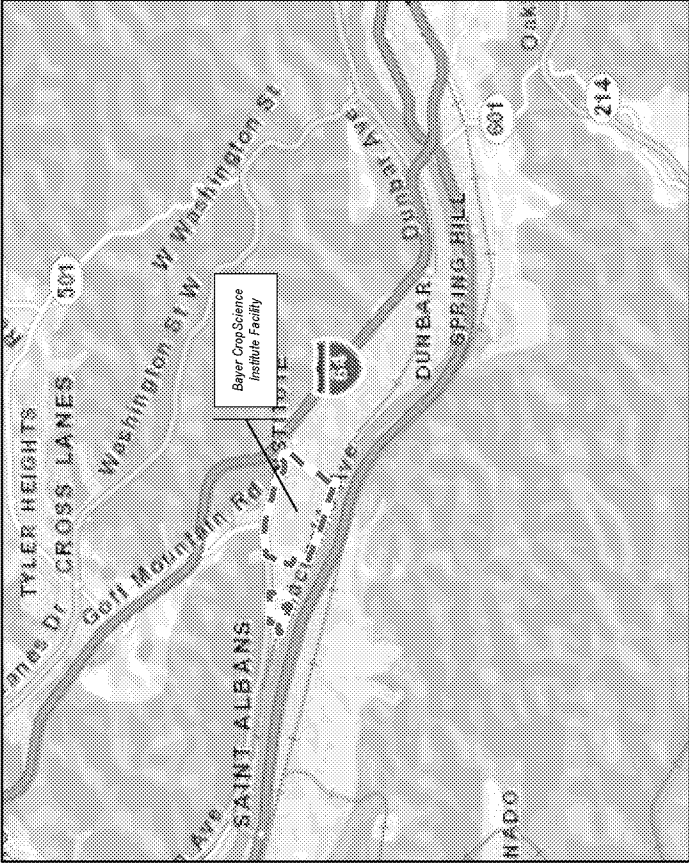
Tank 1010 Area - Detected VOCs Exceeding Pore Water Cleanup Levels
HPH and Tank 1010 Pore Water Characterization Report
Bayer CropScience Facility, Institute, West Virginia

	Groundwater Screening Levels*	Minimum Detection	Maximum Detection	Number of Detections	Frequency of Exceedances	INS-0020 2009	INS-0300	INS-0301	INS-0302	INS-0303	INS-0304	INS-0305	INS-0306	INS-0307	INS-0308	INS-0309	INS-0310	INS-0311		INS-0312	INS-0313	INS-0314	INS-0315
VOCs (mg/l)																			Duplicate				
1,2,4-Trichlorobenzene	--	1.12	1.12	1	0 / 18	1.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	--	1.79	1.79	1	0 / 18	1.79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	--	10.4	33	5	0 / 18	ND	33	13.8	ND	10.4	ND	ND	ND	14.4	ND	ND	ND	ND	ND	ND	ND	ND	21.1
Acetone	--	5.5	136	10	0 / 18	ND	129	68.1	ND	30.9	ND	5.64	ND	41.9	ND	5.5	17.9	ND	ND	11	16	ND	136
Carbon disulfide	0.92	1.9	1.9	1	0 / 18	1.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	--	2.45	4.53	3	0 / 18	ND	ND	ND	ND	ND	2.8	ND	4.53	ND	2.45	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	193	1.23	7.18	5	0 / 18	ND	ND	ND	1.38	ND	ND	1.23	ND	ND	7.18	ND	ND	1.56	1.79	ND	ND	2.87	ND
Toluene	9.8	1.15	3.81	14	0 / 18	ND	1.15	1.52	2.03	ND	3.81	3.4	1.36	ND	1.63	2.87	2.86	3.24	2.83	2.93	1.22	1.73	1.7
XYLENES, TOTAL	67	1.04	2.24	11	0 / 18	ND	1.04	1.1	1.55	ND	1.8	2.07	ND	ND	1.33	1.68	ND	1.88	1.66	1.5	ND	1.15	2.24

Notes:

ND = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
VOCs = volatile organic compounds
µg/L = micrograms per liter
* Screening criteria calculated to be protective of Kanawha River exposure pathways.
-- = Screening criteria not calculated

Figures



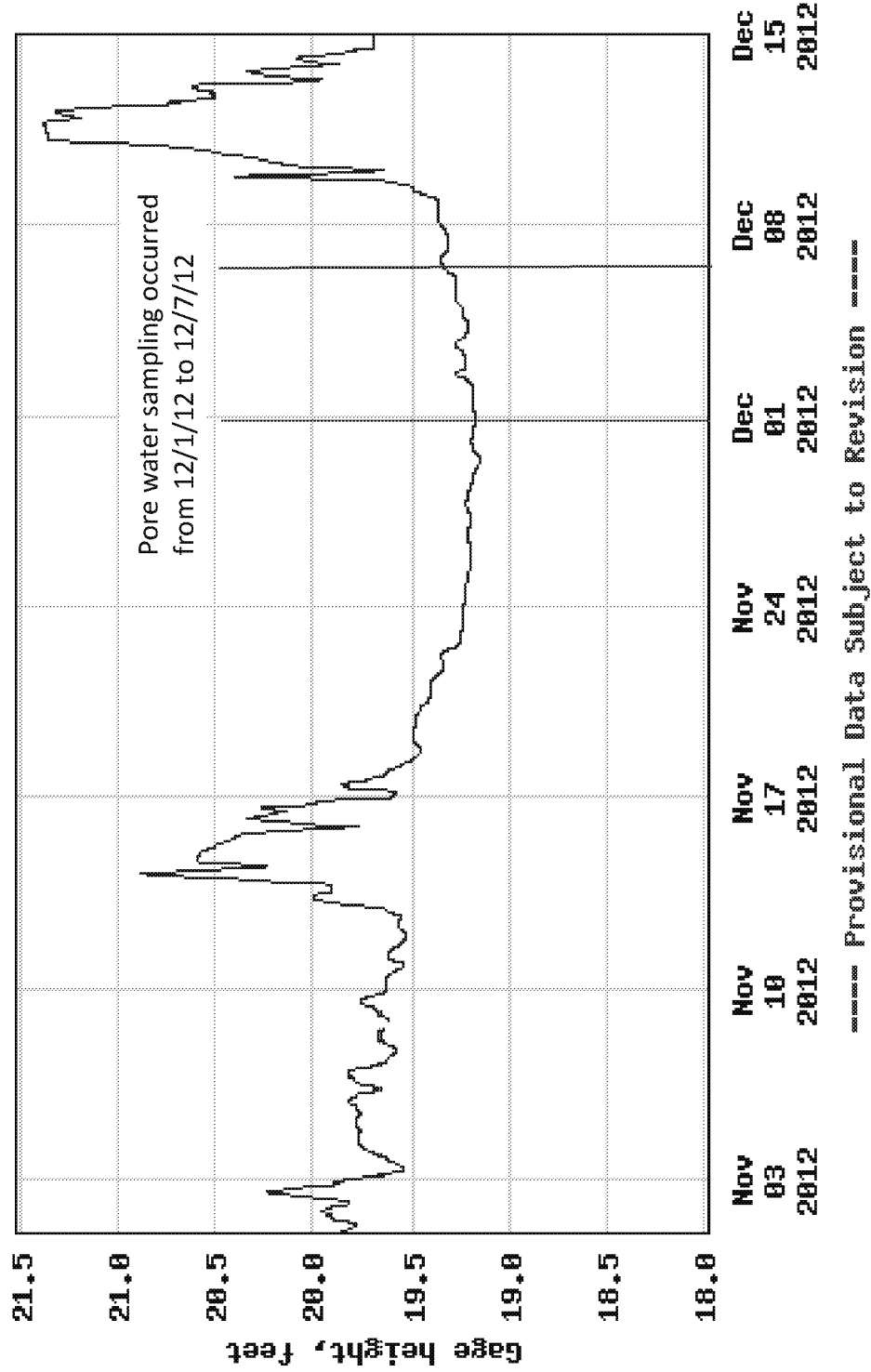
Kanawha River

JLUXH
Facility Location Map
HPH and Tank 1010 Pore Water Characterization Report
Bayer CropScience Institute Facility
Institute, West Virginia



Figure 2-1
Pore Water Sampling Locations
HPD and Tank 1010 Pore Water Characterization Report
Bayer CropScience Institute Facility
Institute, West Virginia

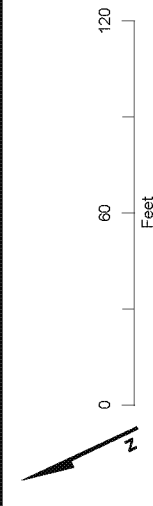
USGS 03197990 KANAWHA R AT CHARLESTON, WV AUXILIARY (UPPER)



Note: Hydrograph obtained from USGS website. <http://waterdata.usgs.gov>

Figure 4-1

Kanawha River Gauge Hydrograph - 2012
 HPH and Tank 1010 Pore Water Characterization Report
 Bayer CropScience Institute Facility
 Institute, West Virginia



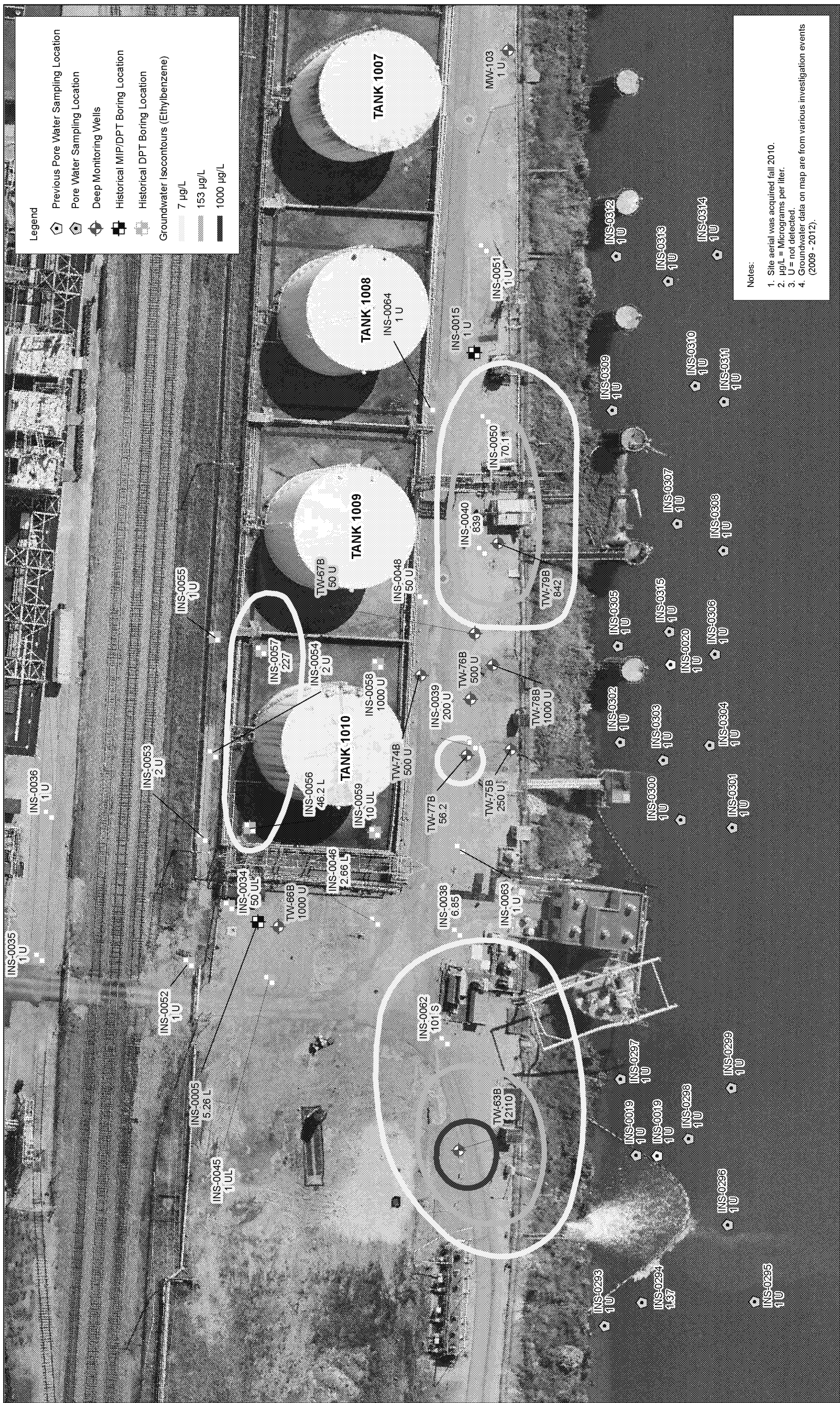
ИЗДАТЕЛЬСТВО

Toluene Isoconcentration Map - Deep Aquifer
HPH and Tank 1010 Pore Water Characterization Report
Bayer CropScience Institute Facility
Institute, West Virginia

MIKE WLAKEFRONTPIROUNGISDOWNSINSTITUTEIREPORTS20134581111TANK101070HPHAREAPOREWATERCHARACTERIZATIONREPORTWAPFILESINSTFIGURE04-1TOLUENEISOCENTRATIONMAPDEEPAQUIFERMXDJHANSEN15/16/20132:30:28PM

CH2M HILL





(XIX)

Ethylbenzene Isoconcentration Map - Deep Aquifer
HPH and Tank 1010 Pore Water Characterization Report
Bayer CropScience Institute Facility
Institute, West Virginia

MIKE WLAKE/FONTPROJGISTDOWNSTITUTITRE/REPORTS/2013/459111_TANK101010HPHAREAPOREWATERCHARACTERIZATIONREPORT/WAP/FILES/INST%20FIGURE04-3_ETHYLBENZENE%20CONCENTRATIONMAP-DEEPAQU/IFER/MXD_JHANS/ENST_5/16/2013%202:27:08 PM

CH2MHILL



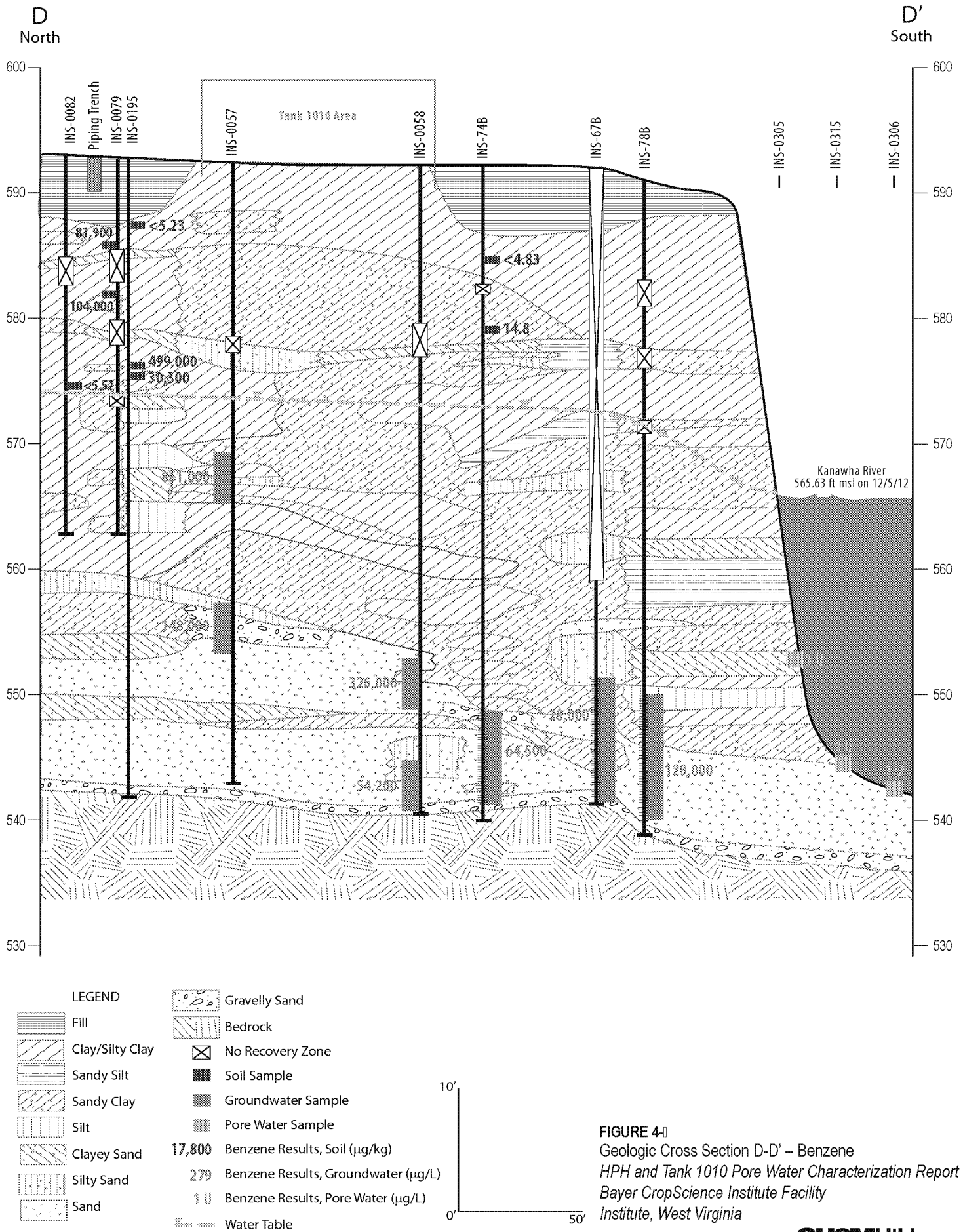
(XIX)

Total Xylenes Isoconcentration Map - Deep Aquifer
HPH and Tank 1010 Pore Water Characterization Report
Bayer CropScience Institute Facility
Institute, West Virginia

MIKE \\LAKEFRONT\\PROJECTS\\DOWNS\\TUTE\\REPORTS\\2013\\459111\\TANK1010\\PHASEA\\REPORT\\MAPFILES\\INST_ FIGURE04_4_XYLENEISOCONCENTRATION\\MAP-DEEPAQUJFER.MXD JHANSNET 5/16/2017 3:23:27 PM

CH2MHILL





Appendix A
Standard Operating Procedure - Trident Probe

STANDARD OPERATING PROCEDURE

7 UGHQW3 UREH² 3 RUH: DMU6 DP SOQJ

The Trident probe is a direct-push, integrated temperature sensor, conductivity sensor, and pore water sampler developed to screen sites for areas where groundwater may be discharging to a surface water body (Chadwick et al. 2003). Differences in observed conductivity and temperature indicate areas where groundwater discharge is occurring. The integral pore water sampler can be used to rapidly confirm the presence of freshwater or other chemical constituents. The primary tasks include the following:

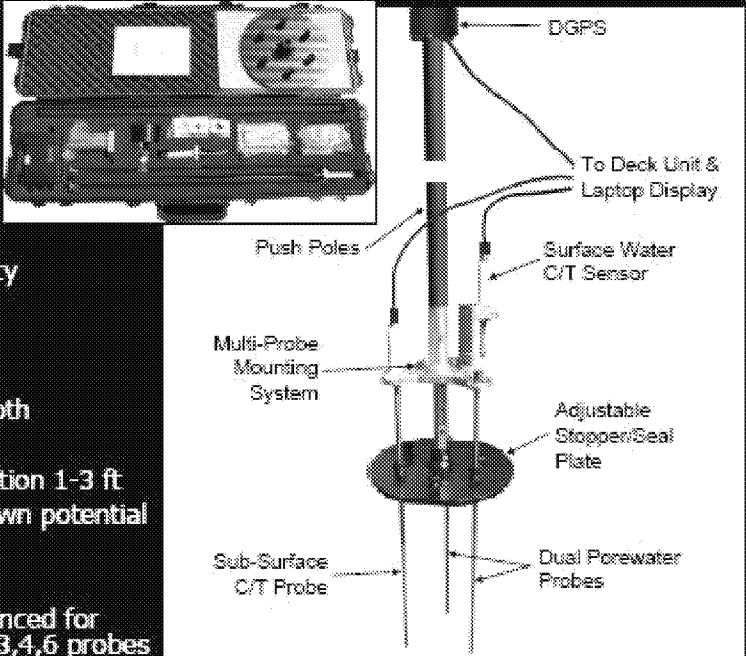
- Setup AGIS – AGIS is the geographical information system software that is used to display the results of the Trident temperature and conductivity sensors in real time. The setup requires importing a map for the project area, setting up the proper coordinate system, and associating the map with the sensor data files of interest.
- Test system – System testing for the Trident probe consists of connecting the probe and GPS units to the deck unit, connecting the deck unit to the laptop, and running the system to make sure all the components are operational. This includes the temperature sensors, the conductivity sensors, the GPS, the deck unit, and the laptop.
- Sensor calibration – After determining the system is operational, the calibrations for the temperature and conductivity sensors must be verified. If the sensors are found to be out of calibration, a new calibration must be performed. For the conductivity sensors, the calibration consists of immersing the sensors in known conductivity standards, recording the raw conductivity signals, determining the regression coefficients for the sensor, and inputting the coefficients into the setup of TridentTalk. The procedure for the temperature sensors is similar but using a temperature bath and a precision calibrated digital thermometer to establish the known temperature conditions. The GPS requires no calibration.
- Pre-clean water sampler – The water sampling probe and all auxiliary sampling equipment must be precleaned using the appropriate solutions for the chemicals that will be analyzed. The pre-cleaning procedure is as follows:
 - Remove surface residuals immediately. Clean water sampling components (fittings, tubing, probes, etc.) as soon as possible, rinsing the items with hot/warm detergent.
 - Hot/warm soak to loosen and float most particulate material. Use a 1 percent Alconox™ detergent solution (10 g/L) in water of 50 degrees Celsius or higher.
 - Hot tap water rinse to flush away floated particulates.
 - Distilled water double-rinse to remove trace deposits from tap water. Use 18 MΩ deionized (organic-free) water.
 - Prior to use, store sampling equipment in clean area. Cap the fittings and isolate smaller items, especially the sampling ports on the probe tips, with protective

covering (Teflon™ or aluminum foil). Before use, rinse probe tips and sample pathways with 18 MΩ deionized (organic-free) water and air-dry.

- Between stations complete an Alconox™ rinse, followed by a deionized rinse.

Trident System Components

- **C/T Sensors:**
 - Surface water
 - Subsurface
- **Porewater Sampler:**
 - Screen point
 - Dual probe
- **Integrated GPS**
 - Differential accuracy
 - GIS display
- **Push pole system:**
 - 6 ft sections
 - 0 – 50 ft water depth
- **Stopper Plate:**
 - Adjustable penetration 1-3 ft
 - Minimizes draw down potential
- **Mounting System**
 - Up to 6 probes
 - Symmetrically balanced for combinations of 2,3,4,6 probes



The diagram illustrates the Trident Probe System components and their assembly. On the left, a photograph shows the system's electronics, including a GPS unit with a screen and a control panel with buttons and a dial. On the right, a schematic diagram shows the vertical assembly of the probe system. Labels with leader lines identify the following parts: DGPS (Differential GPS) at the top; To Deck Unit & Laptop Display connected to the main unit; Push Poles forming the vertical structure; Multi-Probe Mounting System in the middle; Adjustable Stopper/Seal Plate near the bottom; Sub-Surface C/T Probe (Conductivity/Temperature) at the very bottom; and Dual Porewater Probes branching from the side near the stopper plate. A Surface Water C/T Sensor is also shown near the top of the push poles.

),* 85(

Diagram of Trident Probe System

Appendix B

Data Quality Evaluation

Data Quality Evaluation for the Kanawha River Pore Water Investigation, Bayer CropScience Facility Institute, West Virginia

35 (3 \$ 5 (' 0 2 5

Union Carbide Corporation, A Wholly Owned Subsidiary of The Dow Chemical Company

35 (3 \$ 5 (' 0 % <

CH2M HILL

' \$ 7 (

August 10, 2009

, QARGXFMRQ

This data quality evaluation (DQE) report provides an assessment of the data quality of analytical results for pore water samples collected from the Bayer CropScience Facility in Institute, West Virginia. CH2M HILL collected the samples July 10, 2009. Guidance for this DQE report came from the *Program Quality Assurance Project Plan (WVO QAPP)*, November 2006, the U.S. Environmental Protection Agency (USEPA) *Contract Laboratory National Functional Guidelines (NFG) for Organic Data Review*, October 1999, and individual method requirements.

The analytical results were evaluated using the criteria of precision, accuracy, representativeness, comparability, and completeness (PARCC) presented in the WVO QAPP. This report is intended as a general data quality assessment designed to summarize data issues.

\$ QDOWFDO DMD

This DQE report covers three pore water samples, one field duplicate (FD), one equipment blank (EB), and one trip blank (TB). The samples were reported in one sample delivery group (SDG): L09070255. Samples were collected and delivered to Microbac Laboratories Inc. in Marietta, Ohio. The samples were analyzed by the method listed in Table 1.

7 \$ % / (

Analytical Parameters

Kanawha River Pore Water Investigation, Bayer CropScience Facility Institute, West Virginia

Parameter	Method	Laboratory
Volatile organic compounds	SW8260B	Microbac

The SDG was assessed by reviewing the following: (1) the chain-of- custody documentation; (2) holding time compliance; (3) initial and continuing calibration criteria; (4) method blanks/field blanks; (5) laboratory control sample (LCS)/laboratory control sample duplicates (LCSDs); (6) surrogate spike recoveries; (7) internal standard recoveries;

(8) matrix spike (MS)/matrix spike duplicates (MSDs); (9) FD precision; and (10) the required quality control (QC) samples at the specified frequencies.

Data flags were assigned according to the WVO QAPP. Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will only be one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are those listed in the WVO QAPP and are defined below:

- J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- R = The sample result was rejected because of serious deficiencies in the ability to analyze the sample and meet the QC criteria. The presence or absence of the analyte could not be verified.
- U = The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- B = The analyte was detected in the blank as well as the samples.
- K = The analyte was positively identified, but the associated numerical value may be biased high.
- L = The analyte was positively identified, but the associated numerical value may be biased low.
- UL = The analyte was analyzed for but was not detected. The quantitation limit may be higher.

10. SUMMARY

The overall summaries of the data validation are contained in the following sections and Table 2.

10.1. ACCEPTANCE CRITERIA

All acceptance criteria were met.

10.2. CALIBRATION

Initial and continuing calibration analyses were performed as required by the method and generally met acceptance criteria with the following exception:

- The relative response factor (RRF) for 1,4-dioxane was significantly lower than the method criteria in the initial calibration, initial calibration verification (ICV), and continuing calibration verification (CCV), indicating a lack of sensitivity to accurately

detect 1,4-dioxane. All data were rejected for project use and flagged “R” in the samples.

0 HMRG%QDNV

Method blanks were analyzed at the required frequency and were free of contamination.

/ DERUDRU &RQMR06 DP S0M

LCS/LCSDs were analyzed as required, and all accuracy and precision criteria were met.

) LH0%QDNV

EBs and TBs were collected, analyzed, and free of contamination.

,QMLQD06 VQGDUGV

Internal standards met all acceptance criteria.

6XURJDMV

Surrogates met all acceptance criteria.

0 DM [6 SINH6 DP S0M

MS/MSD samples were analyzed as required and met acceptance criteria with the following exception:

- The recovery of 1,4-dioxane was greater than upper control limits in the MS/MSD for sample 0018-PW-071009, indicating a possible high bias. The data were not qualified because the sample did not contain reportable levels of 1,4-dioxane.

) LH0' XSQEDMV

An FD was collected, analyzed, and all precision criteria were met.

&KDIQRI &XWRG

Required procedures were followed and were free of errors.

2 YHLD0\$ WHWP HQV

The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The following summary highlights the PARCC findings for the above-defined events:

- Precision of the data was verified by reviewing the field and laboratory data quality indicators that include LCS/LCSD, MS/MSD, and FD RPDs. Precision was acceptable.
- Accuracy of the data was verified by reviewing the calibration data, MS/MSD, LCS/LCSD, internal standard, and surrogate standard recoveries as well as the evaluation of method/field blank data. Accuracy was generally acceptable with the exception of 1,4-dioxane which was rejected for project use in all samples because of calibration issues. The method/field blanks were free of contamination.

- Representativeness of the data was verified through the sample's collection, storage, and preservation procedures and the verification of holding time compliance. No observations related to sample preservation or storage of the samples were noted by the laboratory. All data were reported from analyses within the USEPA-recommended holding time.
- Comparability of the data was ensured using standard USEPA analytical procedures and standard units for reporting. Results obtained are comparable to industry standards in that the collection and analytical techniques followed approved, documented procedures.
- Completeness is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. Completeness is expressed as the percentage of valid or usable measurements compared to planned measurements. Valid data are defined as all data that are not rejected for project use. All data were considered valid with the exception of 1,4-dioxane, which was rejected for project use in all samples. The completeness goal of 90 percent was met for all compounds except for 1,4-dioxane, which was 0 percent complete.

75% (00)

Data Qualification Summary

Kanawha River Pore Water Investigation, Bayer CropScience Facility Institute, West Virginia

NativeID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
0018-PW-071009	SW8260B	1,4-Dioxane	µg/L	100	R	IC RRF, ICVS RRF, CCV RRF
0018-PW-071009-D	SW8260B	1,4-Dioxane	µg/L	100	R	IC RRF, ICVS RRF, CCV RRF
0019-PW-071009	SW8260B	1,4-Dioxane	µg/L	100	R	IC RRF, ICVS RRF, CCV RRF
0020-PW-071009	SW8260B	1,4-Dioxane	µg/L	100	R	IC RRF, ICVS RRF, CCV RRF
0020-PW-071009	SW8260B	1,4-Dioxane	µg/L	100	R	IC RRF, ICVS RRF, CCV RRF

Validation Reasons:

CCV RRF The continuing calibration verification standard relative response factor was less than method criteria.
 IC RRF The initial calibration relative response factor was less than method criteria.
 ICVS RRF The initial calibration verification relative response factor was less than method criteria.

Data Quality Evaluation for the Kanawha River Pore Water Investigation, Bayer CropScience Facility Institute, West Virginia

35 (3 \$ 5 (' 2 5

Union Carbide Corporation, A Wholly Owned Subsidiary of The Dow Chemical Company

35 (3 \$ 5 (' %

CH2M HILL

' \$ 7 (

January 2013

1. INTRODUCTION

This data quality evaluation (DQE) report provides an assessment of the data quality of analytical results for pore water samples collected from the Bayer CropScience Facility in Institute, West Virginia. CH2M HILL collected samples December 4-7, 2012. Guidance for this DQE report came from the *Dow WVO Quality Assurance Project Plan (November 2006) (WVO QAPP)*; the U.S. Environmental Protection Agency (USEPA) *Contract Laboratory National Functional Guidelines (NFG) for Organic Review, October 1999*; the USEPA *Contract Laboratory (NFG for Inorganic Review, October 2004)*; and individual method requirements.

The analytical results were evaluated using the criteria of precision, accuracy, representativeness, comparability, and completeness (PARCC) as presented in the WVO QAPP. This report is intended as a general data quality assessment designed to summarize data issues.

2. SCOPE AND LIMITATIONS

This DQE report covers 24 pore water samples, 2 field duplicates (FDs), 2 equipment blanks (EBs), and 2 trip blanks (TBs). The samples were reported in two sample delivery groups identified as L12120211 and L12120364. Samples were collected and delivered to Microbac Laboratories, Inc. in Marietta, Ohio. The samples were analyzed by the method listed in Table 1.

7 \$ % (

Analytical Parameters

Pore Water Investigation, Institute, West Virginia

Parameter	Method	Laboratory
Volatile organic compounds	SW8260B	Microbac

The sample delivery groups were assessed by reviewing the following: (1) the chain-of-custody documentation; (2) holding time compliance; (3) initial and continuing calibration criteria; (4) method blanks/field blanks; (5) laboratory control spiking sample

(LCS)/laboratory control spiking sample duplicate (LCSDs) recoveries; (6) matrix spike (MS)/matrix spike duplicate (MSD) recoveries; (7) surrogate spike recoveries; (8) FD precision; (9) internal standard (IS) recoveries; and (10) the required quality control (QC) samples at the specified frequencies.

Data flags were assigned according to the WVO QAPP. Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will only be one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are those listed in the WVO QAPP and are defined below:

- J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- R = The sample result was rejected because of serious deficiencies in the ability to analyze the sample and meet the QC criteria. The presence or absence of the analyte could not be verified.
- U = The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- B = The analyte was detected in the blank as well as the samples.
- K = The analyte was positively identified, but the associated numerical value may be biased high.
- L = The analyte was positively identified, but the associated numerical value may be biased low.
- UL = The analyte was analyzed for but was not detected. The quantitation limit may be biased low.

1 QUALITY

The overall summaries of the data validation are contained in the following sections. Qualified data are listed in Table 2.

2 ACCEPTANCE CRITERIA

All acceptance criteria were met.

3 EXCEPTIONS

Initial and continuing calibration analyses were performed as required by the methods, and acceptance criteria were met with the following exceptions:

- The percent difference (%D) for vinyl chloride was less than criteria in one volatile organic compound (VOC) initial calibration verification standard, indicating a possible

low sample bias. The data were qualified as estimated nondetects and flagged "UJ" in the associated samples. In addition, the %Ds for several analytes were less than method criteria in a few continuing calibration verification standards, indicating a possible low bias. The data were qualified as estimated detected and nondetected results and flagged "J" and "UJ", respectively, in the associated samples.

0 HMRG%QNM

Method blanks were analyzed at the required frequency and were free of contamination.

/ DERLDRU &RQMR06 DP SOM

LCS/LCSDs were analyzed as required, and all accuracy and precision criteria were met.

0 DM [6 SINH

MS/MSD samples were analyzed as required and all accuracy and precision criteria were met with the following exceptions:

- Acetone was recovered greater than the upper control limit in the MS/MSD for sample 0296-PW-120412, indicating a possible high bias. The result was qualified as estimated and flagged "K" in the parent sample.
- The relative percent difference (RPD) for acetone and 2-butanone exceeded criteria in the MS/MSD of sample 0296-PW-120412. Detected results were qualified as estimated and flagged "J" in the parent sample. Nondetected results were not qualified.

,QMLQD06 VQGDUGV

ISs were added to all samples for methods requiring their use, and all acceptance criteria were met.

6XURJDMV

Surrogates were added to all samples for methods requiring their use, and all acceptance criteria were met.

) LHG' XSQFDMV

FDs were collected as required, and precision criteria were met with the following exception:

- The RPD for acetone exceeded criteria in FD pair 0294-PW-120412/ 0294-PW-120412D. The data were qualified as estimated and flagged "J" in the FD pair.

) LHG%QNM

EBs and TBs were collected, analyzed, and were free of contamination.

&KDLQRI &XWRG

Required procedures were followed and were generally free of errors.

2 YHLD0\$ WHMP HQW

The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-

making process. The following summary highlights the PARCC findings for the above-defined events:

- Precision of the data was verified by reviewing the field and laboratory data quality indicators that include FD, LCS/LCSD, and MS/MSD RPDs. Precision was generally acceptable with the exception of acetone, which was qualified as estimated in a few samples because of FD and/or MS/MSD RPD issues. Data users should consider the impact to any result that is qualified as it may contain a bias which could affect the decision-making process.
- Accuracy of the data was verified by reviewing the calibration data, LCS/LCSD, MS/MSD, ISs, and surrogate standard recoveries, as well as the evaluation of method/field blank data. Accuracy was generally acceptable with the exception of a few analytes being qualified as estimated detected and nondetected results because of calibration, and/or MS/MSD issues. All method/field blank data were free of contamination.
- Representativeness of the data was verified through the sample's collection, storage, and preservation procedures and the verification of holding time compliance. The laboratory did not note any issues related to sample preservation or storage of the samples. All data were reported from analyses within the USEPA-recommended holding time.
- Comparability of the data was verified using standard USEPA analytical procedures and standard units for reporting. Results obtained are comparable to industry standards in that the collection and analytical techniques followed approved, documented procedures.
- Completeness is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. Completeness is expressed as the percentage of valid or usable measurements compared to planned measurements. Valid data are defined as all data that are not rejected for project use. All data were considered valid. The completeness goal of 90 percent was met for all method/analytes combinations.

75% ()

Qualified Data

Pore Water Investigation, Institute, West Virginia

1 DATA	0 HMRG	5 QDOVM	8 QLV	5 LQDO 5 HVXQV	9 DQGMRO 5 QJ	9 DQGMRO 5 HVRO
0019-PW-120512	SW8260B	2-Butanone	ug/L	10.5	J	CCV<LCL
0019-PW-120512	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0019-PW-120512	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0293-PW-120412	SW8260B	2-Butanone	ug/L	16	J	CCV<LCL
0293-PW-120412	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0293-PW-120412	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0294-PW-120412	SW8260B	2-Butanone	ug/L	12.8	J	CCV<LCL
0294-PW-120412	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0294-PW-120412	SW8260B	Acetone	ug/L	82.1	J	FD>RPD
0294-PW-120412	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0294-PW-120412D	SW8260B	2-Butanone	ug/L	8.25	J	CCV<LCL
0294-PW-120412D	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0294-PW-120412D	SW8260B	Acetone	ug/L	56.4	J	FD>RPD
0294-PW-120412D	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0295-PW-120412	SW8260B	2-Butanone	ug/L	5	UJ	CCV<LCL
0295-PW-120412	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0295-PW-120412	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0296-PW-120412	SW8260B	2-Butanone	ug/L	5	UJ	CCV<LCL
0296-PW-120412	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0296-PW-120412	SW8260B	Acetone	ug/L	14.3	K	SD>UCL, MSRPD (J)
0296-PW-120412	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0297-PW-120512	SW8260B	2-Butanone	ug/L	8.9	J	CCV<LCL
0297-PW-120512	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0297-PW-120512	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0298-PW-120412	SW8260B	2-Butanone	ug/L	9.1	J	CCV<LCL
0298-PW-120412	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0298-PW-120412	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0299-PW-120412	SW8260B	2-Butanone	ug/L	5	UJ	CCV<LCL
0299-PW-120412	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0299-PW-120412	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL

75% ()

Qualified Data

Pore Water Investigation, Institute, West Virginia

1 DMTH'	0 HMRG	\$ QDOW	8 QW) LQDQ 5 HXQV	9 DQGDMRQ) QJ	9 DQGDMRQ 5 HDVRQ
0300-PW-120512	SW8260B	2-Butanone	ug/L	33	J	CCV<LCL
0300-PW-120512	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0300-PW-120512	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0301-PW-120512	SW8260B	2-Butanone	ug/L	13.8	J	CCV<LCL
0301-PW-120512	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0301-PW-120512	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0302-PW-120512	SW8260B	Vinyl chloride	ug/L	1	UJ	ICVS<LCL
0303-PW-120712	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0304-PW-120512	SW8260B	2-Butanone	ug/L	5	UJ	CCV<LCL
0304-PW-120512	SW8260B	4-Methyl-2-pentanone	ug/L	5	UJ	CCV<LCL
0304-PW-120512	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0305-PW-120612	SW8260B	Vinyl chloride	ug/L	1	UJ	ICVS<LCL
0306-PW-120612	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0307-PW-120712	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0308-PW-120612	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0309-PW-120612	SW8260B	Vinyl chloride	ug/L	1	UJ	ICVS<LCL
0310-PW-120712	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0311-PW-120612	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0311-PW-120612D	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0312-PW-120612	SW8260B	Vinyl chloride	ug/L	1	UJ	ICVS<LCL
0313-PW-120612	SW8260B	Vinyl chloride	ug/L	1	UJ	ICVS<LCL
0314-PW-120612	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL
0315-PW-120712	SW8260B	Bromomethane	ug/L	1	UJ	CCV<LCL

Validation Reasons:

CCV<LCL The continuing calibration verification was recovered less than criteria
 FD>RPD The FD RPD exceeded criteria
 ICVS<LCL The initial calibration verification was recovered less than criteria
 MSRPD The MS/MSD RPD exceeded criteria
 SD>UCL The matrix spike duplicate was recovered greater than the upper control limit

Appendix C
Laboratory Analytical Results

Included on CD

